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THE ROSE-CHAFER:[1] A DESTRUCTIVE GARDEN AND VINEYARD PEST.

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INTRODUCTORY.

About the time of the blossoming of grapes, roses, and many garden flowers a long-legged beetle of a light ocher or yellowish-brown color, called the rose-chafer or "rose-bug," makes its appearance in certain sections of the country and strips bushes and vines of blossoms and foliage. This beetle is about one-third of an inch in length and may be recognized by comparison with the accompanying illustration (fig. 1, *a*).

These insects appear suddenly and in vast swarms in certain years, usually toward the middle of June in the Northern States and about two weeks earlier in their southern range, and overrun the garden, vineyard, orchard, and nursery. In about a month or six weeks from the time of their first arrival, generally after they have done a vast amount of damage, the beetles disappear as suddenly as they came.

DISTRIBUTION.

The rose-chafer occurs in the North, from Canada and Maine southward to Virginia and Tennessee, and westward to Oklahoma and Colorado. It is particularly injurious in Massachusetts, Rhode

[1] *Macrodactylus subspinosus* Fab.; order Coleoptera, family Scarabaeidae.

Island, New Jersey, Delaware, and Ohio, and has been reported as very destructive in portions of New York, Pennsylvania, Maryland, Virginia, West Virginia, Illinois, Indiana, Kansas, Nebraska, southern Michigan, and Vermont, but is not destructive in all portions of these States. Light sandy regions are greatly preferred by the insects as breeding grounds, and clay lands, unless near sandy soil, are seldom troubled with them.

FOOD PLANTS AND INJURY.

For some time after the rose-chafer was first noticed it confined its ravages to the blossoms of the rose. There is a record, however, of its having been destructive to grapes as early as 1810. In later years it has extended its range of food plants until now it is nearly

FIG. 1.—The rose-chafer (*Macrodactylus subspinosus*): *a*, Adult or beetle; *b*, larva; *c*, *d*, mouthparts of larva; *e*, pupa; *f*, injury to leaves and blossoms of grape, with beetles at work. *a*, *b*, *e*, Much enlarged; *c*, *d*, more enlarged; *f*, slightly reduced. (From Marlatt.)

omnivorous. The rose and grapevine especially suffer from its depredations, but it is almost equally destructive to fruit, shade, and other trees and shrubs. In times of great abundance these insects completely destroy flowers and other ornamental plants of many sorts, even attacking berries, peas, beans, and nearly all garden fruits and vegetables, corn, wheat, and grasses. Almost every form of vegetation is devoured.

The beetles do not confine their ravages to any particular portion of a plant, but consume alike blossoms, leaves, and fruit.

In their attack upon the grape they first devour the blossoms, then the leaves, which they completely strip, leaving only a thin network, and later the young berries are eaten (figs. 2 and 3). Whole vine-

yards and orchards are often devastated, and the fruit crop of certain sections of country destroyed. It is no uncommon sight to see every young apple on a tree completely covered and obscured from view by a sprawling, struggling mass of beetles. (See fig. 4.)

Since the late eighties the rose-chafer has been particularly injurious in grape-growing regions and has been the subject of research and experiment at the New Jersey Agricultural Experiment Station and by the Bureau of Entomology in the Lake Erie region of Pennsylvania.[1]

FIG. 2.—Grape foliage showing injury by rose-chafer. (Original.)

ROSE-CHAFER POISONOUS TO CHICKENS.

It has frequently been stated that the rose-chafer is injurious to small chickens, and it was the general belief that their death was due to mechanical injury or puncturing of the lining of the digestive tract by the spines on the legs of the beetles that had been swallowed. In other cases it was stated that the rose-chafer had eaten into the crops of the chicks. Cases have been reported recently of hundreds of chickens being killed in this manner. Death usually occurred in from 9 to 24 hours after feeding. Some experiments have been performed to determine the cause of the injury, and it was proved that

[1] Johnson, Fred. Vineyard spraying experiments against the rose-chafer in the Lake Erie Valley. U. S. Dept. Agr. Bur. Ent. Bul. 97, pt. 3, p. 53–64, pl. 4–7, fig. 16–21. 1911.

15 to 20 rose-chafers were sufficient to cause the death of a chick 1 week old. In the case of a 10-week-old chicken, 96 undigested rose-chafers were counted in a post-mortem examination. An extract made from 40 grams of rose-chafers was injected into rabbits, which died in six minutes, and in one case in three and one-fourth minutes after the injection of 4 c. c. Other rabbits were killed in proportion

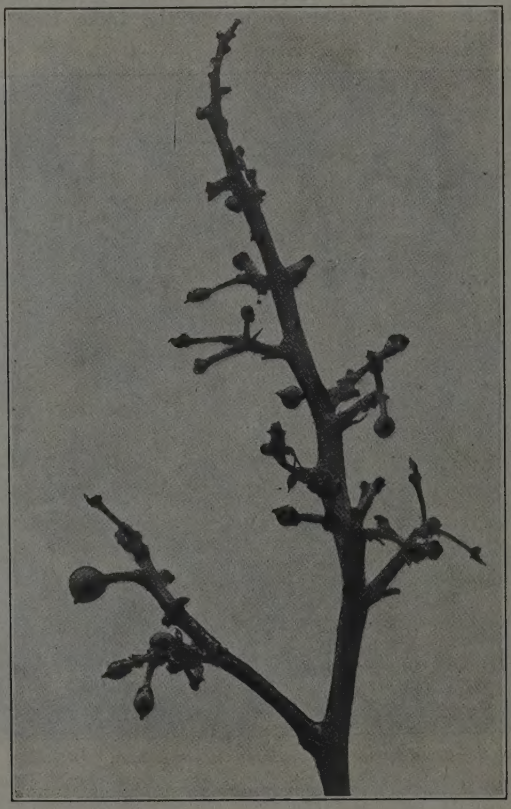

FIG. 3.—Grape cluster showing almost total destruction of young berries through feeding of rose-chafer. (From Johnson.)

to the size and dose. The opinion was reached that owing to the fact that the insect feeds on a large number of plants, and especially on daisies, its body contains a neuro-toxin which affects the hearts of small animals, such as chickens and rabbits.[1]

NATURAL HISTORY AND HABITS.

The rose-chafer, as already stated, appears early in June, the date varying somewhat according to locality and season. Soon after

[1] Lamson, G. H. The poisonous effects of the rose-chafer upon chickens. *In* Science, v. 43, no. 1100, p. 138–139. Jan. 28, 1916.

emerging from the ground it mates and begins feeding. For from four to six weeks after their appearance the beetles continue feeding, almost constantly paired. The female deposits her eggs singly, from 24 to 36 in number, a few inches beneath the surface of the earth, where in from two to three weeks they hatch and the young larvæ or grubs begin feeding on such tender rootlets, preferably of grass, as are in reach. By autumn the larvæ, which are yellowish white in color, with pale-brown heads, have reached full growth and present the appearance shown in figure 1 at *b*. Late in autumn they descend

FIG. 4.—Young apple showing injury by rose-chafer. (Original.)

lower into the earth, below the frost line, each grub forming a little earthen cell in which it passes the winter. In April or early in May they transform to pupæ, and in from two to four weeks afterwards the beetles emerge, dig their way out of the ground, and renew their destructive work. A single generation of the species is produced in a year, and about three weeks is the average duration of life for an individual adult.

METHODS OF CONTROL.

The rose-chafer is one of our most difficult insect enemies to combat successfully. Almost every appropriate method that has ever been employed against other insects has been tried against this one, and much has been written on this insect, but a thoroughly effective remedy is yet to be discovered when the insects appear in excessive

numbers. Every year or two "new and successful remedies" are suggested, but when tested on a large scale in badly infested vineyards or orchards, these are found unsatisfactory.

The greatest difficulty encountered is that any application that may be made is unsuccessful unless applied almost continuously. Poisons that will kill the beetle are not satisfactory when the insects are abundant, because of their comparatively slow action. The blossoms have already been entirely destroyed before the poisons have taken effect, and the dead beetles are constantly being replaced by others that come from the ground or fly from neighboring places. Every beetle on a plant may be destroyed one day, but on the day following the plant will again be completely covered by them. Moreover, it is difficult to spray an entire garden so that every bud and blossom will be coated with the poison.

PRACTICALLY USELESS APPLICATIONS.

The various compounds of copper, lime, kerosene, and pyrethrum, hot water, and other so-called sure remedies have failed to give the desired results when subjected to a rigid test. Some substances, pyrethrum, for example, will stupefy the beetles for a short time, but they soon recover and resume feeding.

Hot water is not effective because of the practical impossibility of applying it in a spray or jet at a sufficiently high temperature to kill the insects and not destroy the fruit and flowers.

Decoctions of tobacco and quassia, as well as solutions of hellebore, alum, and a number of proprietary remedies that have been tried, apparently have no deadly effect on the rose-chafer.

USE OF ARSENICALS ON ROSES.

Paris green has not proved a success against this species, for, while it will not discolor the leaves badly, it will damage the flowers. Furthermore, repeated applications are necessary. When Paris green is added to Bordeaux mixture the combination produces bluish discolorations and seems to have little, if any, effect as a repellent. Arsenate of lead has been tried and found to be more destructive than other arsenicals, acting both as a repellent and a poison, but it works more slowly. It also has the disadvantage, in the case of ornamentals, of leaving a whitish deposit. Arsenite of zinc leaves a still thicker and a more permanent white deposit, and if fish-oil or similar soap is used as the "sticker," or adhesive, this latter substance leaves an unpleasant odor.

It is obvious, therefore, that we can not depend upon any of the arsenical group as preventives of injury by the rose-chafer to roses and other bright-flowering plants, although on some other plants they might be used successfully. Knowing these facts, it is not at all likely that the average rose grower could be induced to use any of the arsenicals.

It is possible that a heavy application of arsenate of lead, say 5 pounds to 50 gallons of either water or Bordeaux mixture, will largely protect ornamental plants that are hardy, and this plan should be tested by those who are confronted with this pest. Very thorough applications should be made on the first signs of the insects' presence and repeated as found necessary.

USE OF ARSENICALS ON GRAPES AND OTHER FRUITS.

Experiments made by the Bureau of Entomology in the grape belt of the Lake Erie Valley during 1910–11 indicate that a considerable degree of protection of vineyards from rose-chafer injury may be obtained by timely and thorough use of arsenical sprays, the amount of benefit varying with the abundance of the insects. Since the use of poison sprays at the time of rose-chafer invasion is desirable for the control of other grape pests, such as the grape berry moth, grape flea-beetle, etc., vineyards in sandy regions and subject to rose-chafer attack should be sprayed regularly for this insect as a part of the routine of vineyard work.

In the Bureau's experiments arsenate of lead has been used at the rate of 5 pounds to each 50 gallons of liquid. The poison preferably should be used in Bordeaux mixture, the application of which is essential for the control of fungous diseases. It is a prevalent belief that the addition to the poison spray of molasses or glucose renders it attractive to the beetles and insures better results. Observations and experiments on this question, while not conclusive, throw doubt on the value of the recommendation.

The first application of spray should be given just before the blossoms open, and if the beetles continue destructive the treatment should be repeated as soon as the blossoms have fallen. Arsenate of lead (paste) should be used at the rate of 4 or 5 pounds to 50 gallons of water or Bordeaux mixture, and the spray should be applied very thoroughly. Vineyardists should adopt a definite spraying schedule,[1] which will insure the maximum protection from the various insects and fungous diseases of the vine. Vineyards regularly sprayed should be less injured by the rose-chafer than those not so treated.

For the destruction of the beetles on fruit trees, as peach, apple, etc., arsenate of lead should be used, preferably in a fungicide, such as Bordeaux mixture, when the beetles first appear. It should be applied at the same strength indicated for vineyards, namely, 4 or 5 pounds to 50 gallons of spray. In spraying peaches and other stone fruits the arsenical should be used in the self-boiled lime-sulphur wash[2] or in water to which has been added lime wash made from slaking 3 or 4 pounds of good stone lime. Repeated applications may be necessary, depending upon the extent of reinfestation of the trees by newly emerged beetles, or those from other sources.

HAND PICKING.

The old-fashioned remedy of hand picking is of service when the beetles infest rose bushes, grapes, or other low-growing plants. The beetles may also be jarred from trees and bushes over sheets saturated with kerosene, but these methods are tedious and must be practiced daily in the early morning or toward sundown to be effective. A number of useful mechanical appliances formed on the plan of a funnel or inverted umbrella, with a bag or can containing kerosene at the bottom, have been devised for the collection of the beetles as they are jarred from the plants.

NETTING AND BAGGING.

Choice plants may be securely protected by a covering of netting, and when the process of bagging may profitably be employed, this method should be followed. Bagging, as is well known, prevents

[1] See Farmers' Bulletin 284, U. S. Department of Agriculture.
[2] See Farmers' Bulletin 440, U. S. Department of Agriculture.

fungous or bacterial infection, and, in addition, flowers so protected are of superior appearance and quality. Bagging of grape clusters for protection against the rose-chafer is often practiced and affords protection against other insect pests as well.

USE OF LURE PLANTS.

Small gardens may be protected, at least from the first arriving hordes of the chafers, by planting about them early-flowering plants that particularly attract the beetles. Spiræas, deutzias, andromeda, magnolias, blackberries, and white roses are especially useful as counter attractives. The beetles swarm on the flowers of these plants in preference to other flowers and small fruits, and when thus massed in great numbers their destruction by the use of collectors or other mechanical means is greatly facilitated.

DESTROYING THE LARVÆ AND PUPÆ.

In addition to the use of any of the methods described above, injury in gardens may be appreciably lessened by preventing the breeding of the insects within or in the immediate vicinity of the garden.

According to experiments conducted in Ohio during the years 1893–94,[1] the rose-chafer may be destroyed by taking advantage of the delicate nature of the pupæ. This insect while in the pupal stage is so extremely sensitive to disturbance that, even with the greatest care, specimens were not successfully transferred to the laboratory for rearing, and all specimens disturbed in their pupal cells perished. Since both larvæ and beetles are very tenacious of life, the pupal stage appears to furnish the most vulnerable period of attack, and large numbers of the pupæ may be destroyed by stirring the breeding grounds, at the appropriate time, to a depth of 3 or more inches. In the latitude of northern Ohio the most favorable time for the application of this remedy is from about May 25 to June 10. In more southern latitudes operations should be commenced earlier.

All ground which might serve as a breeding place and which it is possible so to treat should be plowed and harrowed at the proper time in the spring. The least possible area of light sandy soil should be left in sod, only the heaviest land being used for grass.

GENERAL CONSIDERATIONS.

Whatever practice of a remedial nature is undertaken, whether collecting or spraying, should be begun at the first onset of the insects' attack and continued until their disappearance. Nor should work be confined entirely to those useful plants the preservation of which is desired. Many weeds and wild plants, notably the ox-eye daisy and sumac, are special favorites of this species, and when practicable the beetles should be destroyed on them to prevent their spreading to cultivated land.

If persistent and combined effort on the part of fruit growers and truck growers of limited regions subject to infestation were made against this insect, its numbers might in a few seasons be so diminished that practical immunity from injury would be secured for several years.

[1] Webster, F. M. The rose chafer or rose bug; how to deal with it. *In* 27th Ann. Rept. Ohio State Hort. Soc. f. 1893–94, p. 87–91. 1894.